United States
Department of
Agriculture

Forest Service

**Rocky Mountain
Forest and Range
Experiment Station**

Fort Collins,
Colorado 80526

**Research Paper
RM-280**

Summer Birds and Mammals of Aspen-Conifer Forests in West-Central Colorado

Virgil E. Scott and Glenn L. Crouch

Abstract

Breeding birds and small mammals were inventoried in west-central Colorado, in stands ranging from pure aspen to nearly pure spruce-fir. In aspen, the bird community included several species not found in the conifer-dominated stands, but bird density and diversity were not different. In all, 18 bird species and three small mammals showed responses to the various overstory characteristics.

USDA Forest Service
Research Paper RM–280

October 1988

Summer Birds and Mammals of Aspen-Conifer Forests in West-Central Colorado

Virgil E. Scott, Retired
Denver Wildlife Research Center

and

Glenn L. Crouch, Research Wildlife Biologist
Rocky Mountain Forest and Range Experiment Station[1]

[1]*Headquarters is in Fort Collins, in cooperation with Colorado State University.*

Summer Birds and Mammals of Aspen-Conifer Forests in West-Central Colorado

Virgil E. Scott and Glenn L. Crouch

Management Implications

Aspen and conifer forests provide habitat for many wildlife species in the central Rocky Mountains. Although documentation is poor, the prevailing opinion suggests that aspen overstories provide better habitat for more species than conifer overstories. To test this premise, birds and small mammals were inventoried in pure aspen, aspen-conifer, and nearly pure conifer stands to determine the relative use of such stands during the growing season.

Results suggest that pure aspen stands do not provide habitat for more species or greater bird or mammal densities than conifer stands. Aspen did, however, support some birds and mammals that might otherwise be absent or present in low numbers. Management practices that maintain aspen and conifers in various mixes appear to be most beneficial to the largest number of wildlife species.

Introduction

Plant communities have unique environmental conditions necessary for wildlife niche organization. These niches are a product of a plant community, its successional stages, and other environmental factors including soil type, moisture regime, microclimate, slope, aspect, elevation, and temperature (Thomas 1979). In certain situations, a single factor, often vegetal, exhibits a controlling influence on the aggregation of organisms (Curtis 1959). Dominant organisms, such as trees, influence current environments in ways that tend to sort wildlife species aggregations according to characteristics of the dominant organism (Flack 1976). Bird densities, species richness, and species composition are influenced by tree species composition, tree density, and successional stage of the plant community.

James and Wamer (1982) examined general patterns of density, species richness, and relative abundance of breeding birds of various North American forests from censuses published in "American Birds." They reported:

> 1) The highest density of birds in forests occurs at high values of tree species richness and canopy height and intermediate values of tree density. 2) The highest species richness per unit area occurs at intermediate values of tree species richness, canopy height, and tree density. 3) The lowest density and species richness of birds occurs in areas of low tree species richness, low canopy height, and high density of small trees.

Some disparity exists in the few publications concerning bird densities and diversities found in coniferous versus deciduous forests. Winternitz (1980) reported higher density and diversity in aspen (*Populus tremuloides*) than in adjacent coniferous forests. Salt (1957) also reported higher bird densities in aspen but noted a similar number of species in aspen and spruce-fir communities near Jackson Hole, Wyo. In Wales, Adams and Edington (1973) reported greater songbird species diversity in broadleaved than in coniferous sites, but the total number of birds was not different between the two sites.

Armstrong (1977) compared small mammal captures from several habitats in Colorado, including aspen and Engelmann spruce (*Picea engelmannii*). He captured more shrews (*Sorex* spp.), southern red-backed voles (*Clethrionomys gapperi*), and heather voles (*Phenacomys intermedius*) in Engelmann spruce, and more chipmunks (*Eutamius* spp.) in aspen. Deer mice (*Peromyscus maniculatus*) and voles (*Microtus* spp.) were nearly equal in numbers within the two habitats. Page et al. (1978) reported deer mice as the most abundant small mammal in mature aspen in Nevada. Shrews (*Sorex vagrans* and *S. monticolus*), long-tailed voles (*Microtus longicaudus*), golden-mantled ground squirrels (*Spermophilus lateralis*), jumping mice (*Zapus* spp.), Great Basin pocket mice (*Perognathus parvus*), Heermann's kangaroo rat (*Dipodomys heermanni*), and a few chipmunks were also caught. Hunt (1979) reported southern red-backed voles as the most abundant species in mature aspen in Saskatchewan; deer mice, meadow voles (*Microtus pennsylvanicus*), and shrews were less numerous. In the subalpine forests [subalpine fir (*Abies lasiocarpa*)-Engelmann spruce-lodgepole pine (*Pinus contorta*)] on the Fraser Experimental Forest in Colorado, Scott et al. (1982) reported southern red-backed voles as the most numerous small mammal. Fewer least chipmunks (*Tamias minimus*), deer mice, shrews, and montane voles (*Microtus montanus*) were caught.

Our study, on the species richness of birds and mammals found in aspen, conifer, and mixed (aspen-conifer) forests, was conducted on the northern portion of Coulter Mesa in west-central Colorado.

Study Area

Coulter Mesa is on the White River National Forest, about 20 miles north of Rifle, Colo. At 9,000 feet, the mesa is rolling terrain with a mosaic of small to extensive woodlands intermixed with high elevation grasslands. Some of the woodlands are nearly pure aspen or conifer stands while others consist of mixtures (figs. 1–3). Livestock graze on the area during summer, and mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) are present during spring, summer, and fall.

Methods

Aerial photographs were used to select two forest stands in each of the following five overstory categories: (1) nearly 100% aspen; (2) 75% aspen, 25% conifer; (3) 50% aspen, 50% conifer; (4) 25% aspen, 75% conifer; and (5) nearly 100% conifer. The stands selected had to be large enough (>40 acres) for bird survey plots to be at least 200 feet from large meadows. Small openings were present within some of the stands.

Figure 1.—Basal area 99 percent aspen.

Figure 2.—Basal area 50 percent conifer; 50 percent aspen.

Figure 3.—Basal area 100 percent aspen.

Trees were sampled with a 20-factor prism from 16 stations on each of the selected forest stands, and the numbers of trees and snags by size class were determined according to Beers and Miller (1964).

Birds were inventoried three times during June 1980 and 1981 on 16 variable-radius circular plots per stand (Reynolds et al. 1980). Mammals were live-trapped in Sherman traps on 9 by 11 grids (99 traps) with 50-foot spacing between traps in each stand. One trap (baited with peanut butter and rolled oats) was placed at each station and checked twice daily for 6 days during August of each year. Each mammal caught was ear-tagged and released. Data are presented as numbers of untagged mammals caught per 100 trap nights. Pocket gopher (*Thomomys* spp.) mounds were counted on 50 0.01-acre plots on each stand (Reid et al. 1966). Counts were made 48 hours after all existing mounds were eliminated on each sample plot. Red squirrel (*Tamiasciurus hudsonicus*) caches were counted on 16 0.1-acre plots in each stand.

Linear regression ($r \geq 0.44$, 18 df, $p < 0.05$) was used to determine the significance of relationships between densities of birds and mammals and several habitat variables, with data for different years combined for analysis.[2] A diversity profile for birds was prepared following Patil and Taillie (1979); lines in the profile that do not cross indicate differences in species diversity.

Results and Discussion

Overstory

Tree species composition differed from that targeted when stands were selected from aerial photos (table 1). The mean aspen basal area percentages for the five overstory categories were actually 98, 78, 64, 31, and 1. Mean tree diameter was smallest in the aspen plots and largest in the conifer plots, where trees up to 36 inches d.b.h. were measured. Density of snags ≥8 inches d.b.h. ranged from 3 to 26 per acre with the lowest number occurring in the aspen stands. Density generally increased with conifer composition. The nearly pure conifer sites, however, had fewer snags than the other conifer-dominated stands. Total basal area was not different among stands, ranging from 118 to 194 square feet per acre.

Birds

Fewer species of birds were observed in the aspen and conifer stands than in the mixtures, but diversity was lower only in the aspen (fig. 4). Species observed only once in an overstory category were excluded from the diversity profile.

Yellow-bellied sapsuckers, black-capped chickadees, white-crowned sparrows, Hammond's flycatchers, Clark's nutcrackers, and mountain bluebirds were

[2]*The quantative statements (greater or lesser, increases or decreases, etc.) used in the following section indicate that the relationships reported are significant (p = 0.05).*

Table 1.—Overstory characteristics of study sites, Coulter Mesa, Colo.

Aspen percent	Basal area ft²/acre		Trees/acre		Mean d.b.h. (in)		Snags/acre
	Aspen	Conifer	Aspen	Conifer	Aspen	Conifer	(>8 in d.b.h.)
98	131	3	362	3	8.2	13.5	3
74	100	35	198	49	10.6	11.4	7
64	94	52	131	74	11.6	11.3	14
31	54	123	93	174	11.0	11.4	22
1	2	150	2	166	14.5	12.8	13

observed in the aspen-dominated stands but not in those dominated by conifers. (Scientific names of birds are given in tables 2–5.)

Originally, we separated birds into eight feeding and nesting guilds to determine if birds within guilds responded similarly to aspen-conifer composition. Only cavity-nesters and three ground foraging species were correlated with overstory variables. Ground-foraging birds were more numerous in aspen and increased with aspen basal area. As expected, numbers of cavity-nesting birds were positively correlated with the number of snags and conifer basal area. On aspen-dominated plots (≥50% basal area), 16–38% of the birds found were cavity-nesters; where conifers dominated, cavity-nesters accounted for 37–40%. Generally, birds within guilds did not respond similarly to overstory differences. Guild division may be more appropriate with birds in monotypic forests, or the guild concept may not be strongly habitat-associated.

In tables 2–5, we have separated birds into four groups: (1) those with densities positively correlated with aspen basal area; (2) those with densities negatively correlated with aspen basal area; (3) species not correlated with aspen basal area but indicating an affinity for similar habitats among themselves in a correlation matrix; and (4) birds that responded independently to aspen and conifer basal area and did not show an affinity for similar habitats. Independent birds tended to be low in density, and their sample sizes may have been too small to exhibit relationships to either overstory composition or other birds.

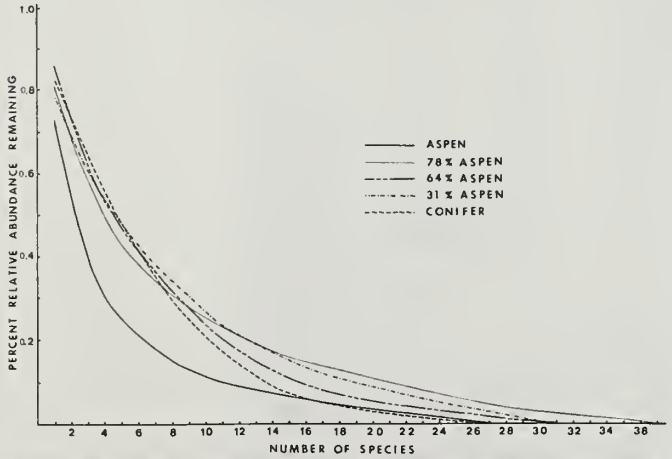

Figure 4.—Species diversity profile of bird communities, Coulter Mesa, Colo.

Seven species were positively correlated with aspen basal area (table 2). Three were ground-feeders and four were canopy-feeders. The four canopy-feeders (house wrens, yellow-rumped warblers, warbling vireos, and black-capped chickadees) were also correlated with herbaceous production.[3] Northern flickers, American robins, and dark-eyed juncos, all ground-feeders, were positively correlated with aspen basal area.

Eleven bird species were negatively correlated with aspen basal area (table 3). Of those, hermit thrushes were the only ground-feeders more numerous in conifer stands than in aspen. Four cavity-nesters—hairy woodpeckers, mountain chickadees, red-breasted nuthatches, and brown creepers—were more common in pure conifer than in pure aspen stands, although some of the highest densities occurred in mixtures of aspen and conifers. Golden-crowned kinglets were more numerous in conifer-dominated mixed stands, whereas ruby-crowned kinglets were more abundant in the nearly pure conifer stands. Other birds negatively correlated with aspen were gray jays, western tanagers, pine grosbeaks, and pine siskins.

Six species not correlated with basal area showed similar habitat preferences among themselves in the correlation matrix (table 4). As a group, these birds tended to be more numerous in the mixed stands, although individually, none had higher densities in mixed than in pure aspen or conifer stands.

Nine independent bird species tended to be more numerous in mixed stands, although their total number among overstory categories was not different (table 5).

Mammals

The total number of mammals caught per 100 trap-nights was not different among overstory categories (table 6). Numbers of least chipmunks were the same among stands. Deer mice showed no preference for any overstory category but were positively correlated with frequency of woody material on the ground. Southern red-backed voles were more numerous in stands where conifers comprised 50% or more of the basal area and were also positively correlated with the frequency of grounded wood. Montane voles caught only in the first year were uncommon.

The number of gopher mounds present were positively correlated with aspen basal area and herbaceous production. Red squirrel caches were more abundant in the conifer-dominated stands.

[3]*Understory data are in the files of the junior author.*

Conclusions

The number of bird species observed in aspen was lower than in mixed aspen-conifer stands, but not markedly different from the number in the conifer stands. Total bird density was not different among stands; but several birds were more abundant in aspen, conifer, or mixed forests. The aspen-dominated stands, with fewer snags and smaller trees, probably reflect earlier successional stages than the other stands, but bird diversity and density were not different from the conifer stands, which represent the older successional stage. The greatest number of bird species was recorded in mixed stands.

Salt (1957) and Winternitz (1980) reported higher total bird densities and diversities in aspen than in conifer forests; however, both studies were conducted where riparian vegetation could have influenced response to the aspen habitat, whereas the conifer forests were upslope and not so influenced. Our study was conducted in stands with similar elevations, aspects, and moisture conditions. Our results suggest that pure aspen forests do not provide habitat for more species or greater bird or mammal densities than conifer forests. Aspen does, however, provide habitat for some birds and mammals that might otherwise be either absent or present in low numbers in the central Rocky Mountains. The greatest

Table 2.—Densities of birds (no./100 acres) positively correlated ($r \geq 0.44$, 18 df) with aspen basal area, Coulter Mesa, Colo.

Species	Overstory category (% aspen)					Correlation coefficient
	98	78	64	31	1	
Northern flicker (*Colaptes auratus*)	7	3	4	2	1	0.62
Black-capped chickadee (*Parus atricapillus*)	8	5	3	6	0	0.46
House wren (*Troglodytes aedon*)	18	33	29	4	7	0.46
American robin (*Turdus migratorius*)	29	29	21	14	18	0.50
Warbling vireo (*Vireo gilvus*)	42	59	46	5	2	0.64
Yellow-rumped warbler (*Dendroica coronata*)	56	69	55	35	28	0.54
Dark-eyed junco (*Junco hyemalis*)	74	52	38	33	20	0.68
Total	234	250	196	99	76	

Table 3.—Densities of birds (no./100 acre) negatively correlated ($r \geq 0.44$, 18 df) with aspen basal area, Coulter Mesa, Colo.

Species	Overstory category (% aspen)					Correlation coefficient
	98	78	64	31	1	
Hairy woodpecker (*Picoides villosus*)	4	3	4	5	10	-0.45
Gray jay (*Perisoreus canadensis*)	0	4	3	6	14	-0.70
Mountain chickadee (*Parus gambeli*)	6	17	42	52	47	-0.73
Red-breasted nuthatch (*Sitta canadensis*)	1	8	16	23	22	-0.79
Brown creeper (*Certhia americana*)	0	12	14	30	43	-0.84
Golden-crowned kinglet (*Regulus satrapa*)	0	2	11	29	20	-0.53
Ruby-crowned kinglet (*Regulus calendula*)	2	14	24	26	38	-0.77
Hermit thrush (*Catharus guttatus*)	1	2	2	7	8	-0.88
Western tanager (*Piranga ludoviciana*)	2	6	6	5	11	-0.52
Pine grosbeak (*Pinicola enucleator*)	0	0	1	6	5	-0.54
Pine siskin (*Carduelis pinus*)	3	5	7	11	23	-0.74
Total	19	73	130	200	241	

Table 4.—Densities of birds (no./100 acres) not correlated with aspen basal area but indicating affinity for similar habitats, Coulter Mesa, Colo.

Species	Overstory category (% aspen)				
	98	78	64	31	1
Western wood-pewee (*Contopus sordidulus*)	7	12	18	4	7
Flycatchers (*Empidonax* spp.)	10	6	22	5	3
Chipping sparrow (*Spizella passerina*)	4	16	1	2	1
Song sparrow (*Melospiza melodia*)	2	7	5	1	1
White-crowned sparrow (*Zonotrichia leucophrys*)	3	9	0	0	0
House finch (*Carpodacus mexicanus*)	2	2	5	0	2
Total	28	52	51	12	14

Table 5.—Densities of birds (no./100 acres) not correlated with aspen basal area nor indicating affinity for similar habitats, Coulter Mesa, Colo.

Species	Overstory category (% aspen)				
	98	78	64	31	1
Yellow-bellied sapsucker (*Sphyrapicus varius*)	1	0	3	1	0
Williamson's sapsucker (*Sphyrapicus thyroideus*)	0	2	0	5	3
Downy woodpecker (*Picoides pubescens*)	3	4	1	0	4
Three-toed woodpecker (*Picoides tridactylus*)	1	1	4	6	2
Olive-sided flycatcher (*Contopus borealis*)	0	2	6	3	6
Swallows (tree & violet-green) (*Tachycineta bicolor & thalassina*)	1	4	7	4	1
Steller's jay (*Cyanocitta stelleri*)	1	4	2	2	1
White-breasted nuthatch (*Sitta carolinensis*)	1	2	1	0	2
Cassin's finch (*Carpodacus cassinii*)	2	8	4	4	1
Total	10	27	28	25	20

Table 6.—Number of mammals caught/100 trap-nights and number of gopher mounds and squirrel caches counted/acre in aspen, conifer, and various mixtures of aspen-conifer, Coulter Mesa, Colo.

Species	Overstory category (% aspen)					Correlation coefficient[1]
	98	78	64	31	1	
Least chipmunk (*Tamias minimus*)	4.5	5.8	2.5	4.0	2.4	0.29
Deer mouse (*Peromyscus maniculatus*)	3.6	3.2	3.8	3.3	5.0	-0.28
Southern red-backed vole (*Clethrionomys gapperi*)	1.4	2.4	5.9	5.3	5.1	0.63[1]
Montane vole (*Microtus montanus*)	0.8	0.3	0.3	0.2	0.4	0.17
Long-tailed vole (*M. longicaudus*)	0.2	0.7	0.2	0.4	0.3	0.04
Total	10.7	12.9	13.2	13.8	13.6	0.24
New pocket gopher mounds/acre (*Thomomys talpoides*)	238	100	126	10	47	0.75[1]
Red squirrel caches/acre (*Tamiasciurus hudsonicus*)	0.2	0.2	1.0	4.8	6.4	-0.94[1]

[1]*Significant at p = 0.05.*

value of aspen as bird habitat seems to occur when it is mixed with conifer, thus providing a variety of habitats.

Literature Cited

Adams, Marjorie W.; Edington, J.M. 1973. A comparison of songbird populations in mature coniferous and broadleaved woods. Journal of Institute of Foresters of Great Britain. 46: 191–202.

Armstrong, David M. 1977. Ecological distribution of small mammals in the Upper Williams Fork Basin, Grand County, Colorado. Southwestern Naturalist. 22: 289–304.

Beers, T.W.; Miller, C.I. 1964. Point sampling: research results, theory, and applications. Res. Bull. No. 786. Lafayette, IN. Purdue University Agricultural Experiment Station. 56 p.

Curtis, John T. 1959. The vegetation of Wisconsin. Madison, WI: University of Wisconsin Press. 657 p.

Flack, J.A. Douglas. 1976. Bird populations of aspen forests in western North America. Ornithological Monographs No. 19. Lawrence, KS: Allen Press, Inc. 97 p.

Hunt, Hugh M. 1979. Small mammals in aspen clearcuts. Blue Jay. 37: 173–180.

James, Francis C.; Wamer, Noel O. 1982. Relationships between temperate forest bird communities and vegetative structure. Ecology. 63: 159–171.

Page, Jerry L.; Dodd, Norris; Osborne, Tim O.; Carson, Jennifer A. 1978. The influence of livestock grazing on non-game wildlife. Cal-Neva Wildlife. 1978: 159–173.

Patil, G.P.; Taillie, C. 1979. A study of diversity profiles and orderings for a bird community in the vicinity of Colstrip, Montana. In: Patil, G.P.; Rosenzweig, M., eds. Contemporary quantitative ecology and related econometrics. Fairland, MD: International Cooperative Publishing House: 23–48.

Reid, V.H.; Hansen, R.M.; Ward, A.L. 1966. Counting mounds and earth plugs to census mountain pocket gophers. Journal of Wildlife Management. 30: 327–334.

Reynolds, R.T.; Scott, J.M.; Nussbaum, R.A. 1980. A variable circular-plot method for estimating bird numbers. Condor 82: 309–313.

Salt, George William. 1957. An analysis of avifauna in the Teton Mountains and Jackson Hole, Wyoming. Condor. 59: 373–393.

Scott, Virgil E.; Crouch, Glenn L.; Whelan, Jill A. 1982. Responses of birds and small mammals to clearcutting in a subalpine forest in central Colorado. Res. Note RM-422. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 6 p.

Thomas, Jack Ward, tech. ed. 1979. Wildlife habitats in managed forests of the Blue Mountains of Oregon and Washington. Agric. Handbk. 553. Washington, DC: U.S. Department of Agriculture, Forest Service. 512 p.

Winternitz, Barbara L. 1980. Birds in aspen. In: Management of western forests and grasslands for nongame birds: proceedings of the workshop; 1980 February 11–14. Salt Lake City, UT. Gen. Tech. Rep. INT-86. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain and Rocky Mountain Forest and Range Experiment Stations: 247–257.

Scott, Virgil E.; Crouch, Glenn L. 1988. Summer birds and mammals of aspen-conifer forests in west-central Colorado. Res. Pap. RM–280. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 6 p.

Breeding birds and small mammals were inventoried in west-central Colorado, in stands ranging from pure aspen to nearly pure spruce-fir. In aspen, the bird community included several species not found in the conifer-dominated stands, but bird density and diversity were not different. In all, 18 bird species and three small mammals showed responses to the various overstory characteristics.

Keywords: Birds, mammals, aspen, conifers, habitat, Rocky Mountains

Rocky Mountains

Southwest

Great Plains

U.S. Department of Agriculture
Forest Service

Rocky Mountain Forest and Range Experiment Station

The Rocky Mountain Station is one of eight regional experiment stations, plus the Forest Products Laboratory and the Washington Office Staff, that make up the Forest Service research organization.

RESEARCH FOCUS

Research programs at the Rocky Mountain Station are coordinated with area universities and with other institutions. Many studies are conducted on a cooperative basis to accelerate solutions to problems involving range, water, wildlife and fish habitat, human and community development, timber, recreation, protection, and multiresource evaluation.

RESEARCH LOCATIONS

Research Work Units of the Rocky Mountain Station are operated in cooperation with universities in the following cities:

Albuquerque, New Mexico
Flagstaff, Arizona
Fort Collins, Colorado*
Laramie, Wyoming
Lincoln, Nebraska
Rapid City, South Dakota
Tempe, Arizona

*Station Headquarters: 240 W. Prospect St., Fort Collins, CO 80526